CLAIMS

We claim:

1. A system for sensing a wavefront of light passed through an optical device, comprising:

a device under test (DUT) holder adapted to hold the optical device;

a point light source adapted to provide light to the optical device;

a movable platform adapted to move the point light source with respect to the optical device;

a first lens adapted to receive and pass therethrough a light beam from the optical device;

a range-limiting aperture adapted to receive and pass therethrough at least a portion of the light beam from the first lens;

a second lens adapted to receive and pass therethrough the portion of the light beam from the range-limiting aperture;

a Shack-Hartmann wavefront sensor adapted to receive the portion of the light beam from the second lens and to produce therefrom wavefront data; and

a processor adapted to receive the wavefront data from the wavefront sensor and to control movement of the movable platform to move the point light source to a location about one focal length away from the optical device.

2. The system of claim 1, wherein the point light source is a laser.

3. The system of claim 1, further comprising a position digitizer adapted to detect location data of the movable platform and to provide the location data to the processor.

4. The system of claim 1, wherein the optical device is an ophthalmic lens and the DUT holder is adapted to hold the ophthalmic lens.

5. The system of claim 1, wherein the processor is adapted to determine aberrations of a wavefront of the portion of the light beam received by the wavefront sensor.

6. The system of claim 5, wherein the processor is adapted to provide a feedback signal to control movement of the movable platform.

7. The system of claim 6, wherein the processor is adapted to determine, from the wavefront data, a relative curvature of the wavefront of the portion of the light beam received by the wavefront sensor.

8. The system of claim 1 wherein the Shack-Hartmann sensor comprises:

a lenslet array receive the portion of the light beam from the second lens and to produce a corresponding plurality of light spots therefrom; and

a pixel array receiving the light spots from the lenslet array, the pixel array being divided into a plurality of areas of interest each having a plurality of pixels and each

corresponding to one lenslet of the lenslet array.

9. The system of claim 8, wherein the range limiting aperture has a size approximately equal to a size of one of the areas of interest.

10. The system of claim 8, wherein the range limiting aperture has a shape approximately the same as a shape of one of the areas of interest.

11. A method of sensing a wavefront of light passing through an optically transmissive device, comprising:

locating a light source a first distance from the optically transmissive device

passing light from the light source through the optically transmissive device;

imaging at least a portion of the light passed through the optically transmissive device;

sensing a wavefront of the imaged light to produce therefrom wavefront data; and

adjusting a distance between the light source and the optically transmissive device to substantially maximize a degree of collimation of the light passed through the optically transmissive device.

12. The method of claim 11, wherein adjusting the distance between the light source and the optically transmissive device comprises:

processing the wavefront data to determine a degree of collimation of the light passed through the optically transmissive device; and

generating therefrom a feedback signal to control movement of the light source to substantially maximize the degree of collimation of the light passed through the optically transmissive device.

13. The method of claim 12, wherein processing the wavefront data to determine a degree of collimation of the light passed through the optically transmissive device includes determining, from the wavefront data, a relative curvature of a wavefront of the light passed through the optically transmissive device.

14. The method of claim 12, wherein sensing the wavefront of the imaged light includes projecting a plurality of light spots onto a pixel array, and wherein processing the wavefront data to determine a degree of collimation of the light passed through the optically transmissive device includes determining a separation of the light spots.

15. The method of claim 12, further comprising determining a second distance between the light source and the optically transmissive device when the degree of collimation of the light passed through the optically transmissive device is substantially maximized.

16. The method of claim 11, further comprising determining a second distance between the light source and the optically transmissive device when the degree of collimation of the light passed through the optically transmissive device is substantially maximized.

17. The method of claim 11, further comprising passing the portion of the light through a range-limiting aperture.

18. The method of claim 17, wherein the wavefront of the imaged light is sensed with a Shack-Hartmann wavefront sensor.

19. The method of claim 18, wherein the range-limiting aperture is adapted to insure that the Shack-Hartmann wavefront sensor is never out of range.

20. The method of claim 18, wherein the Shack-Hartmann sensor comprises:

a lenslet array receive the portion of the light beam from the second lens and to produce a corresponding plurality of light spots therefrom; and

a pixel array receiving the light spots from the lenslet array, the pixel array being divided into a plurality of areas of interest each having a plurality of pixels and each corresponding to one lenslet of the lenslet array, and

wherein the range limiting aperture has a size approximately equal to a size of one of the areas of interest.

21. The method of claim 11, wherein adjusting a distance between the light source and the optically transmissive device comprises moving the optically transmissive device.

22. A system for sensing a wavefront of light passed through an optically

transmissive device, comprising:

a light source disposed on a first side of an optically transmissive device;

a wavefront sensor disposed on a second side of an optically transmissive device;

a relay imaging system disposed between the optically transmissive device and the wavefront sensor; and

means for adjusting a distance between the light source and the optically transmissive device.

23. The system of claim 22, wherein the relay imaging system includes a range-limiting aperture disposed at an internal focal point between two lenses.

24. The system of claim 22, further comprising means for determining the distance between the light source and the optically transmissive device.

25. The system of claim 22 wherein the means for adjusting the distance between the light source and the optically transmissive device includes a movable platform to which the light source is attached.

26. The system of claim 25, wherein the means for adjusting the distance between the light source and the optically transmissive device further includes a processor producing a control signal for transporting the movable platform.

27. The system of claim 22 wherein the means for adjusting the distance between the light source and the optically transmissive device includes a movable platform to which optically transmissive device is attached.

28. The system of claim 22, wherein the optically transmissive device is an ophthalmic lens and wherein the system includes a holder adapted to hold the ophthalmic lens.

29. The system of claim 22, wherein the means for adjusting a distance between the light source and the optically transmissive device includes means for automatically setting the distance between the light source and the optically transmissive device equal to the focal length of the optically transmissive device.

30. The system of claim 22 wherein the light source is a laser.

31. The system of claim 22, further comprising means for detecting a distance between the light source and the optically transmissive device.

32. The system of claim 31, wherein the means for detecting a distance between the light source and the optically transmissive device comprises a position digitizer.

33. A method of determining a focal length of a lens, comprising:

(1) locating a light source a first distance from the optically transmissive device;

(2) passing light from the light source through the optically transmissive device;

(3) imaging at least a portion of the light passed through the optically transmissive device;

(4) sensing a wavefront of the imaged light; adjusting a location of the light source with respect to the optically transmissive device to substantially maximize a degree of collimation of the light passed through the optically transmissive device;

(5) moving the light source by a distance x_i from the location that substantially maximizes the degree of collimation of the light passed through the optically transmissive device, where i=(1, N);

(6) sensing a wavefront of the imaged light;

(7) calculating a radius of curvature value of the sensed wavefront;

(8) repeating the steps (5) through (7) N-1 times (where N is an integer) where the value of x_i is changed each time the steps (5) through (7) are repeated; and

(9) calculating the focal length of the lens from the N radii of curvature values calculated in the steps (5) though (8).